THE AMERICAN
JOURNAL OF PHARMACY

JUNE, 1895.

AN EXAMINATION OF COMMERCIAL FLUID EXTRACTS.

By Frederick W. Haussmann.

Every pharmacist who has handled fluid extracts obtained from different manufacturers, must have noticed the variation in their physical properties, as pertaining to color, odor and taste, and also as shown in their miscibility with water or other liquids.

These variations, which were in a number of instances of a striking nature, induced the writer to make a series of examinations, not primarily regarding their chemical composition, such as the alkaloidal percentage, but more particularly the menstruum, as compared with that required by the Pharmacopœia, and also to determine the causes which led to the differences mentioned in their physical properties.

The first feature to which our attention is called, lies in the various shades of color which are frequently observed in fluid extracts prepared from the same drug.

Due to the high degree of heat at which some fluid extracts are evaporated, variations in odor and taste are also noticeable at times. Extracts whose properties are due to volatile principles, such as buchu, cubeb, eucalyptus, etc., are liable to be affected in this manner.

The physical condition of fluid extracts, as regards their fluidity, varies considerably, and in this respect, as probably in no other, the preparations of some manufacturers are characterized.

Some we find of a decidedly syrupy consistence, especially those with a low alcohol percentage, while others are more approximate to the pharmacopœial products. These variations may be partly due to differences in the physical properties of crude drugs, but in many

cases also to the tendency of some manufacturers to economize that most important menstruum constituent, *alcohol.* Unfortunately, specific gravity is no criterion of the alcohol percentage of fluid extracts.

It is true, that an extract of a high specific gravity, for which the Pharmacopœia directs a largely alcoholic menstruum, must be regarded with suspicion, but it does not furnish the means to determine the alcohol percentage of the employed menstruum with any degree of accuracy.

While handling a number of commercial fluid extracts, the high specific gravity of some, contrary to his experience with the same official fluid extracts, induced the writer to determine their alcohol percentage.

Taking the menstrua of the Pharmacopœia as the standard authority, with which the manufacturer, as well as the pharmacist, should comply, comparisons were made between the alcohol percentage found and that required. The extracts examined were taken at random from the preparations of different firms, and regarded as representing the respective average percentage of their preparations. The following table gives the results obtained :

Fluid Extract.	Sp. Gr.	Pharmacopœial Menstruum in Alcohol Percentage by Volume of Official.	Alcohol Percentage Found.	
			Weight.	Volume.
Buchu	·885	Alcohol.	76	82
Buchu	·956	"	56	64
Cimicifuga	·873	"	76	82
Cubeb	·882	"	73	80
Rhubarb	1·0095	80	55	63
Serpentaria	·9255	80	61	69
Calumba	1·042	75	34	41
Senega	1·0085	75	43	51
Chirata	·989	66	38	45
Digitalis	1·008	"	43	50
Phytolacca Root.	·9855	"	51	59
Hydrastis	1·080	60	26	31
Gentian	1·0985	50	27	32
Rhamnus Pursh.	1·052	"	12	15
Senna	1 080	"	25	31
Stillingia	·9855	"	36	43
Taraxacum	1·103	"	12	15
Glycyrrhiza	1·0395	30	23	28
Sarsaparilla Comp.	1·0465	"	6	7
Triticum	1·1296	25	17	21
Prunus Virginiana	1·1025	—	30	36

In the last-mentioned extract, the exact alcoholic percentage of the menstruum cannot be stated, as the Pharmacopœia directs the drug to be macerated with a mixture of water and glycerin, to be followed by percolation with a mixture of 85 parts alcohol and 15 parts water.

The largest percentage of alcohol in fluid extracts, whose menstruum consists entirely of that liquid, was found in F. E. Cimicifuga, the smallest in F. E. Buchu.

The two samples examined of the latter were from different manufacturers, and a glance upon the table will reveal a decided difference in their respective alcohol percentages. Fluid extracts for which the Pharmacopœia directs a menstruum of 2 parts of alcohol to 1 of water, contained a comparatively larger alcohol percentage than those for which the same authority requests an alcoholic menstruum of 3 parts of alcohol to 1 part of water. F. E. of Calumba, which belongs to the latter class, was found to contain only 34 per cent. of absolute alcohol, while F. E. Phytolacca, representing the former, contained 51 per cent.

A small alcoholic percentage was also found in a syrupy F. E. Hydrastis.

Remarkable variations were found in fluid extracts with a supposed-to-be diluted alcohol menstruum. The largest percentage found was in F. E. Stillingia, 36 per cent., which is closely approximate to the pharmacopœial requirement.

F. E. Cascara Sagrada and Taraxacum contained only 12 per cent. of alcohol, by weight.

Compound F. E. Sarsaparilla, with a menstruum of 30 per cent. of alcohol, was found to contain 6 per cent., by weight, while F. E. Glycyrrhiza, with the same alcoholic menstruum percentage, contained 23 per cent.

GLUCOSE IN FLUID EXTRACTS.

The syrupy condition of some commercial fluid extracts, and the sweet taste, occasionally observed in preparations from bitter or acrid drugs, induced the writer to determine the percentage of glucose, or, what is perhaps a more correct statement, an allied substance, which likewise has the property of giving the various glucose reactions.

In addition to this, the negative result experienced in some instances, where the preparations were made from drugs, which are

not stated to have an appreciable saccharine percentage, or whose sugar, if present, is stated not to possess the power of reducing Fehling's solution, was also the basis for these examinations.

Such was, for instance, found to be the case with several samples of F. E. Gentian, which showed by repeated examination the presence of 5 per cent. of a substance corresponding to glucose in every respect.

According to published authorities, gentianose, the sugar present in gentian root, does not reduce Fehling's solution. This has not been the writer's experience, either in the commercial fluid extract or in a sample which was prepared strictly according to the pharmacopœial directions. The remarkably high sugar percentage of some fluid extracts prepared from ranunculaceous plant drugs, which, on comparison with similar official fluid extracts, showed a vast difference, was likewise another reason for this investigation.

Glucose is a normal constituent of many plants, also lævulose, or fruit sugar, which possesses likewise the property of reducing Fehling's solution.

In the process of preparation of galenical preparations, it may also be produced by the decomposition of other compounds, such as inulin, triticin, particularly in the presence of heat. These may be regarded as being some of the natural sources of the sugar which is liable to be present in fluid extracts. Again, excessive heat in their evaporation will have the effect of caramelizing some of the constituents, which, however, by careful observation of pharmacopœial directions, is obviated. Besides this, the claim is made, that caramel is frequently added by manufacturers of fluid extracts on a large scale, for the purpose of coloring their preparations.

The fallacious popular idea that darkness in color is an indication of strength and a criterion of quality is unfortunately also accepted by a number of pharmacists.

Caramel also has the property of reducing Fehling's solution, and forms, in some fluid extracts, when examined for glucose, an important factor.

Glucose cannot be detected with certainty directly in fluid extracts, or liquids containing other vegetable matter. These compounds, as, for instance, tannin, have also the property of reducing Fehling's solution, and must, therefore, first be removed.

The process recommended in Dragendorff's Plant Analysis, precipitation with basic lead acetate, and subsequent treatment with sulphuric acid, was employed.

Ten c.c. of the fluid extract under examination was diluted with water to 20 c.c.

In most cases the mixture became cloudy, and filtration, until a clear liquid was obtained, was necessary.

The mixture was then precipitated with basic lead acetate solution, filtered from the precipitate and the excess of lead in the filtrate carefully precipitated by diluted sulphuric acid.

The liquid, by means of washing the precipitate with water, was made up to the original volume of 20 c.c.

As a rule the effect of picric acid test solution upon the liquid representing 50 per cent. of the fluid extract, was first noted, and also a superficial examination for glucose made by means of the picric acid and potash method of Braun with the intention of determining the necessary degree of dilution before making the volumetric examination with Fehling's solution.

A few statements must be made regarding fluid extracts in general, before quoting the results obtained. In samples containing caramel, if the same is present in considerable amount, the filtrate, after the lead and acid treatment, is of a brown color.

Caramel is not precipitated by basic lead acetate, and through this fact evidence of its presence was shown in a number of fluid extracts.

For instance, in a sample of F. E. Taraxacum, prepared by the writer according to the Pharmacopœia, the final filtrate, after this treatment, was almost colorless, while in several commercial specimens, similarly treated, the same was decidedly brown. A like observation was also made with F. E. Gentian and several others.

The preparations examined by the writer comprised the products of eight different manufacturing firms, the samples all being selected at random, preferring, however, those official, wherever obtainable.

The amount of glucose, or, perhaps, more appropriately, the substance which reduces Fehling's solution and gives reactions with other glucose reagents, varied considerably, some extracts showing a high percentage, while others only contained scarcely appreciable traces. Due to lack of time, the percentage was not ascertained in some, while in a number several determinations were made.

The following were the figures obtained:

(1) Twenty samples were examined of this firm, and they are arranged according to the amount of glucose found.

Five per cent. and over. F. E. Taraxacum, Triticum, Gentian and Cimicifuga.

Four per cent. F. E. Cascara Sagrada. 3·5 per cent. F. E. Rheum. 2·5 per cent. Buchu, Prunus Virginiana, Senna, Hydrastis, Asclepias.

One per cent. Grindelia Robusta, ·833 per cent. Humulus and Digitalis, ·5 per cent. Ipecacuanha.

F. E. Belladonna leaves, Calumba and Nux Vomica, also contained sugar in small amount, but no quantitative estimation was made.

F. E. Coca contained less than 0·5 per cent.

F. E. Cubeb, which was also examined, was found perfectly free from all saccharine matter.

(2) From this source 8 samples were examined, quantitative determinations being made in each case.

The largest percentage found was 5 per cent. in F. E. Pulsatilla; 3·5 per cent. was found in Cypripedium; 3 per cent. in Buchu; 2·5 per cent. each in Frangula, Ipecacuanha and Pilocarpus; ·5 per cent. in Rhus Glabra, while the smallest amount found was in F. E. Damiana, namely, ·35 per cent.

(3) Five extracts were examined from this source.

The average glucose percentage of these preparations was small, the largest amount being found in F. E. Stillingia, which contained 1·66 per cent., the smallest in F. E. Aconite Root, which only gave indication to the extent of ·1 per cent.

F. E. Dulcamara contained about 1·5 per cent.; Belladonna root, 1·25 per cent.; and Eucalyptus, ·625 per cent.

(4) This source furnished 5 samples.

The largest amount was found in F. E. of Phytollacca, the fruit, which was over 7 per cent.

This is, however, no criterion, as the drug contains considerable fruit sugar.

F. E. Granati Rad. Cortex gave indication of ·67 per cent.; Euphorbia pilulifera, ·5 per cent.

F. E. Pichi and Quebracho were also examined, and revealed but small amounts, so that a quantitative estimation was not made.

(5) Four samples were examined from this source. The largest percentage was found in F. E. Bryonia, 1·668, per cent., in Hydrangea ·712, while in F. E. Xanthoxylum and Lippia Mexicana the exact amount was not ascertained.

(6) Three samples were procured from this source. The largest percentage was found in F. E. Convallaria, which was 2·5 per cent.; F. E. Stigmata Maydis contained 1 per cent., while F. E. Belladonna Leaves showed 5 per cent.

(7) Two samples were obtained from this firm. The largest amount of glucose was found in F. E. Burdock Root, which was 5 per cent. F. E. Pimpinella contained 1·67 per cent.

(8) The two samples from this source were F. E. Coca and Humulus.

The hop fluid extract contained the largest amount, 2 per cent.; the other contained 1 per cent.

A few remarks may perhaps be not inappropriate regarding these determinations.

The remarkably high glucose percentage in some of the representatives of the Ranunculaceae, 5 per cent. each in F. E. Cimicifuga and Pulsatilla, obtained, by the way, from different manufacturers, induced the writer to determine the amount of glucose in F. E. Cimicifuga, prepared by himself.

While traces of glucose were present, determinations by Fehling's solution showed the presence of less than 1 per cent.

The small amount present was also indicated by the fact that Braun's or Boettger's bismuth test, when applied, responded but feebly.

This is remarkable, as the commercial extract examined bore but little evidence of the presence of caramel. (In the pulsatilla sample, the presence of the latter was, however, very evident.)

To determine whether the process of evaporation of the final percolate produced any material change in the glucose percentage found, examination was made respectively before and after the evaporated extract was incorporated with the reserved portion, but no material difference was revealed.

Similar determinations were made with fluid extracts of gentian and rhubarb, with a like result.

Evaporation at the temperature directed by the Pharmacopœia does not appear to produce any material change—in particular, no appreciable increase of the glucose percentage.

Comparison was also made between fluid extracts, prepared from the same drug and obtained from different manufacturers.

As already stated, considerable variation in color is frequently observable, and this is in many instances due to the presence of caramel.

Regarding their glucose percentage, some variation also exists.

In a sample of F. E. Buchu, the percentage of one sample was 2·5; of another, 3 per cent. The filtrate of the former, after the lead and acid treatment, was almost colorless; of the latter, a decided brown.

In F. E. Belladonna leaves the glucose percentage of one sample was ·5 per cent.; of another, less than ·2 per cent. Incidentally may be noticed, that the narcotic fluid extracts in general appear to contain but little sugar.

This was observed in F. E. Belladonna leaves, hyoscyamus and also in digitalis.

F. E. Coca leaves, of a deep black color, obtained from one firm, showed a glucose percentage of 1 , while the dark green preparation of another firm showed less than ·5 per cent.

F. E. Humulus, from one firm, strongly alcoholic, precipitating resin on dilution with water, gave indication of about ·830 per cent. of glucose, while the dark brown miscible extract from another source indicated 2 per cent.

F. E. Ipecacuanha showed in one instance a percentage of ·5; in another, 2·5 per cent.

Other comparisons were also made, but the above may illustrate the claim that commercial fluid extracts, as a rule, are not alike in physical properties and composition as obtained from different manufacturers.

Interesting revelations are made in some fluid extracts after subjecting them to the lead and acid treatment mentioned.

If to the final filtrate picric acid test solution is added, alkaloids, if present in the drug, will be indicated.

Among those affected in this manner may be mentioned F. E. Coca, Ipecac, Hydrastis, Quebracho, Cimicifuga, Xanthoxylum, Calumba, and a number of others.

Fluorescent compounds were revealed in the filtrates from F. E. Pichi and Hydrangea, the fluorescence in each being increased by the addition of an alkali.

Comparison was also made between commercial fluid extracts and some prepared from the same drug according to pharmacopœial directions.

F. E. Cimicifuga has already received mention.

F. E. Gentian readily reduces Fehling's solution, both in the official and commercial preparations.

The samples of the commercial extracts examined, however, showed a glucose percentage of over 5 per cent., while the official preparation was found to contain 2·5 per cent. A like result was also found in F. E. Taraxacum.

This preparation, when made according to the Pharmacopœia, contained between 2 and 3 per cent. of glucose, while two samples of the commercial fluid extract, showed between 5 and 6 per cent. to be present. The presence of caramel was, however, noticeable in both.

A sample of commercial F. E. Calumba gave ready indication of the presence of glucose, while the preparation made from the drug by the writer was found to be perfectly free from the same. All the available tests for glucose gave a negative indication of its presence.

F. E. Rhubarb, prepared by the writer, was found to contain about 1 per cent. of glucose.

Two commercial samples were found to contain respectively 3 and 4 per cent

A number of similar comparisons were also made, furnishing, in the main, like results.

Incidentally it may also be mentioned that, while making the above examinations, the presence of possible metallic contamination was also inquired into. In a number of commercial samples the presence of copper was easily detected, showing that but little discrimination was used in the selection of the working utensils.

The importance of self-manufacture in this class of preparations cannot be too strongly urged upon the pharmacist, if it is his desire to comply strictly with the Pharmacopœia.

While it is impossible for him to do so in every instance, there is no reason why he should not manufacture those frequently used, and in whose reliability he can have absolute confidence.

In commercial fluid extracts his only authority is the manufacturer's statement upon the label.

THE TANNIN OF CLOVES.

By Wm. L. Peabody, Ph.G.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. No. 140.

The United States Dispensatory (17th edition, page 331) states that Trommsdorff found 18 per cent. of tannin in cloves. The National Dispensatory (5th edition, page 417) states that the same investigator obtained 13 per cent. of tannin, and adds, in parentheses, "which has not been further investigated."

Whether this parenthetical clause is an expression of doubt as to the occurrence of the principle in such quantity, or is intended by the editors of that authority to direct attention to the nature of the tannin of this aromatic drug, the writer is not assured. So, in order to further investigate this matter, he procured and estimated samples of powdered cloves from the cities named in the tabulated results, and subsequently isolated the tannin from an authentic specimen with the intention of classifying it.

The estimations were made upon decoctions prepared by completely exhausting twenty grammes of the powdered air-dry sample with hot water; when the liquid had cooled it was mixed with enough water to make one litre and then filtered.

Upon trial the method of estimation which involves the precipitation of the tannin by gelatin in the presence of alum was found to be ill-adapted for application to cloves, for the reason that the precipitated matter clogged the filter upon which it was to be collected, to such an extent that it was feared decomposition would take place before the filtration of the mixture and the washing of the precipitate could be accomplished. This process having been abandoned, the plan of estimation tried next was that known as the "Hide-powder Method," and, as no difficulty was experienced in the use of it, this method was accordingly employed on all of the samples.

The application of the process consisted in siphoning some of the decoction through previously rasped raw hide contained in a small glass percolator, which was made to serve as the short arm of the siphon, it having been inverted in a vessel containing the decoction. A rubber tube attached to the neck of the percolator so arranged, and leading into a graduated cylinder, constituted the long arm of the apparatus.

After allowing sufficient time for the liquid to thoroughly penetrate the hide, the flow of the siphon was started by gentle suction applied to the long arm. The hide retained the tannin and coloring matter, but allowed the other constituents of the decoction to pass through in solution.

The first 30 c.c. of the liquid obtained in this manner were considered as containing the soluble matter of the hide, and were therefore rejected. The succeeding 50 c.c. that were received from the siphon were evaporated to a constant weight on a water-bath to ascertain the amount of solids unabsorbed by the hide. 50 c.c. of the original decoction were likewise evaporated to a constant weight to determine the total solids present. The difference between the weights of the solids in these equal volumes was taken as the amount of tannin absorbed by the hide, and from this quantity the percentage was calculated by simple proportion to the weight of air-dry cloves represented by this volume of decoction.

The following results were obtained:

Sample No.	Where Obtained.	Percentage of Tannin.
1	St. Louis	10·50
2	Philadelphia	11·60
3	Philadelphia	12·65
4	New York	10·03
5	Philadelphia	12·00
6	St. Louis	13·35
7	St. Louis	5·50

The samples, with the exception of No. 7, were obtained from the better wholesale and retail stores. No. 7 was purposely bought from the very cheapest trade in order to estimate the tannin in an adulterated article.

Based upon the difference in percentage of tannin found, an estimation of that principle might be of some service in deciding whether a sample of cloves was of good quality.

ISOLATION AND PURIFICATION.

To extract the tannin in order that an investigation of its chemical characters might be made, a quantity of powdered cloves of good quality was exhausted by percolation with acetone. The solvent was recovered from the percolate by distillation, the residual extract thoroughly agitated with water, and the resulting mixture filtered. The filtrate was agitated with acetic ether, which removed some

coloring matter, but no tannin. The aqueous layer from the above operation was saturated with sodium chloride and again shaken with acetic ether. In the presence of the sodium chloride, the coloring matter and almost all of the tannin were readily removed from the aqueous liquid by agitation with three successive portions of acetic ether. These were united and the solvent recovered. The residue so obtained was treated with water, which left considerable wax, oil and resin undissolved. The solution was filtered and the filtrate shaken with acetic ether as before. The acetic ether layer was separated and the solvent recovered. The residue left was treated with water and the filtered solution shaken with acetic ether in the manner described. After several repetitions, this process indicated its value to separate the resinous constituents from the tannin. But a considerable waste of that principle was found to have occurred when the acetone extract was treated with water for the first time. To obviate this loss, which arose through precipitation of the tannin along with the resin, a second method of purification was instituted. This consisted in mixing the acetone percolate of another lot of the same quality of cloves, and from which the solvent had not been recovered, with sufficient water to completely precipitate it. Paper-pulp was uniformly distributed throughout the unfiltered mixture in order to fully clarify the aqueous solution. This treatment proved successful; the pulp retained the oil, wax and resin so effectually that a clear liquid was obtained by simple filtration. Some acetone was added to this liquid to replace that lost by evaporation, and the entire solution afterwards saturated with sodium chloride. The last substance caused the acetone to separate as a supernatant layer. When this was removed and the solvent recovered, a considerable quantity of tannin was obtained. Further agitation with two successive portions of acetone sufficed to exhaust the aqueous layer of tannin.

The product obtained upon the recovery of the acetone was equal in purity to that in hand when the process of repetition at first employed was discontinued, while the attendant waste of tannin was very much less.

From both the first and second methods of isolation, the tannin, upon the recovery of acetic ether or acetone, was obtained in a porous or "puffed-up" condition. The products of both processes were dissolved in the same portion of water, the solution treated

with paper-pulp, the resulting mixture filtered, and the clear filtrate shaken repeatedly with ether to remove the last traces of oil and resin. From the aqueous layer, after the separation of the last portion of ether, the tannin was removed by the addition of acetone and subsequent saturation of the liquid with sodium chloride. The acetone layer, which was thus separated, was removed, and the solvent recovered. The residue was dissolved in water, the solution filtered, and the filtrate agitated with ether. The ether layer was separated and the aqueous layer distilled under reduced pressure to dryness. The resulting tannin was of a straw-yellow color. To render it more porous, the tannin was dissolved in a mixture of absolute alcohol and ether, and these solvents rapidly vaporized under greatly diminished pressure.

CLASSIFICATION.

The tannin, isolated and purified by the process already described, was submitted to a series of experiments, by means of which its chemical behaviors and composition might be ascertained and its classification therefrom decided.

Reactions.—The following reactions were obtained from a one per cent. solution of the tannin in water. For comparison, the reactions afforded by gallotannic acid and white-oak bark tannin—representatives of the two classes of tannins now recognized—are placed beside those given by the tannin of cloves:

Reagent.	Tannin of Cloves.	Gallotannic acid.	White Oak Bark Tannin.
Bromine water	No ppt.	No ppt.	Yellow ppt.
Ferric chloride	Bluish-green ppt.	Blue color and ppt.	Green color and ppt.
Lead nitrate	Light yellow ppt.	White ppt.	
Cobalt acetate	Brownish ppt.	Purple ppt.	
Manganese acetate	Yellowish ppt.	White ppt.	
Uranium acetate	Dark brown ppt.	Brown ppt.	
Copper sulphate and Ammonium hydrate	Slight ppt. Dark brown ppt.	No ppt. Brown ppt	
Sodium sulphite	Yellowish-pink color	Very slight pink color.	Yellow color with streaks of pink.
Ammonio-ferric sulphate	Bluish-green ppt.	Blue color and ppt.	Green color and ppt.
Calcium hydrate	No red color, on long standing turning green.	Ppt. turning blue.	Ppt. turning pink.
Pine shaving with hydrochloric acid	No violet color.	Slight green color.	Violet color.
Stannous chloride and hydrochloric acid	No change in color.	No change in color.	Pinkish color.

It will be seen that the preceding reactions point to a similarity of the tannin of cloves to that of galls rather than to the tannin of white oak bark.

Action of Heat.—0·5 gramme of the tannin were heated with a few cubic centimetres of glycerin to 150° C., for twenty minutes. The heat was then gradually raised to 190° C., at which temperature it was maintained for a short time. The resulting mixture was allowed to cool. It was then shaken with several portions of ether, which removed, and, upon evaporation, left a crystalline substance. This was dissolved in water. The aqueous solution reacted as follows:

Calcium hydrate, red color; becoming a precipitate.
Ferric chloride, green or brownish-green color.
Ferric acetate, green or brownish-green color.
Ferrous sulphate, no change.

Action of Acids.—Two grammes of the tannin were added to 100 c.c. of 2 per cent. (absolute gas) hydrochloric acid. The liquid was heated to boiling, whereby a large part of the tannin was dissolved in a few minutes with the production of a reddish-brown solution. When the liquid had been boiling for an hour all of the tannin had entered solution. After the lapse of three hours the boiling solution had separated a dirty substance, but no red precipitate of phlobaphene character. The liquid was then allowed to cool, the insoluble substance filtered out and the filtrate shaken several times with ether. The mixed ethereal solutions when allowed to evaporate left a crystalline substance, whose water solution reacted in a way to indicate gallic acid, as follows:

Potassium cyanide, red color that faded, but, upon agitation, was restored.
Potassium hydrate, green color.
Ferric chloride, blue color, turning to green.
Ferrous sulphate, violet color, turning to brown, in neutral solution.
Ammoniacal silver nitrate, reduced.
Fehling's solution, reduced.
Lead oxyacetate, precipitate.
Lead acetate, precipitate, filtrate not pptd. by lead oxyacetate.
Pine shaving and HCl, no violet or red color.

The dirty substance that separated while the liquid was boiling was treated with hot alcohol, in which it was almost entirely soluble. The solution so obtained was set aside to allow the alcohol

to evaporate spontaneously. The residue left upon evaporation was dissolved in water and the solution tested with these reagents:

Calcium hydrate, brown color.
Ferric chloride, blue color, changing to green precipitate.
Ferric acetate, greenish-black color.
Ferrous sulphate, blue color; slight precipitate.

Action of Fused Alkali.—0 5 gramme of tannin were gradually added to potassium hydrate in the state of fusion. When first brought into contact with the alkali, the tannin swelled into a white, spongy mass, but, upon stirring, it readily mixed with the fused alkali and produced a brown solution. During this treatment, which was conducted for twenty minutes, an odor similar to that noticed in soap-making was emitted.

The products of the fusion were allowed to cool, and afterwards dissolved in water. The solution was neutralized with dilute sulphuric acid, and shaken several times with successive portions of ether. The ethereal layers were mixed and the bulk of solvent recovered by distillation. The last portion was allowed to evaporate spontaneously. It left a residue, the water solution of which gave the following reactions:

Potassium cyanide, red color, fading, but upon agitation was restored.
Potassium hydrate, red color.
Ferric chloride, blue color, changing to green precipitate.
Ferrous sulphate, violet color.
Ammoniacal silver nitrate, reduced.
Fehling's solution, reduced.
Lead oxyacetate, precipitate.
Lead acetate, precipitate, filtrate giving white ppt. with lead oxyacetate.
Pine shaving and HCl, no violet or red color.

Acetyl Derivative.—0·250 gramme of the tannin were boiled with acetic anhydride for an hour. The resulting solution was then poured into water, which caused the precipitation of a gummy mass that became hard and brittle upon standing in contact with the water. This mass had a brown color. When dried and powdered it was found to have a melting point of 145° C.

Ultimate Analysis.—While the reactions afforded by the products of the several treatments to which the tannin was subjected were in no case distinctly indicative of any of the four substances to be expected from the decomposition of the two classes of tannin, still they point to pyrogallol and gallic acid—products of the decomposition

of gallotannic acid—rather than to catechol and protocatechuic acid, which are derived in like manner from oak bark tannin. The partial vitiation of those reactions was undoubtedly due to the inability of the process of purification to separate every trace of the oil and resin which were associated so tenaciously with the tannin. In order, therefore, to conclusively decide to which class the tannin of cloves belongs, two combustions were made of a quantity of the principle that had been dried at 120° C.

The centesimal composition of gallotannic acid and of white oak bark tannin are supplied for comparison with the results of these elementary analyses:

	Tannin of Cloves.				
	I.	II.	Average.	Gallotannic Acid.	White Oak Bark Tannin.
Carbon	52·95	51·80	52·37	52·10	59·95
Hydrogen	3·71	3·66	3·69	3·52	5·04
Oxygen	43·34	44·54	43·94	44·38	35·01
	100·00	100·00	100·00	100·00	100·00

The results of these investigations may, therefore, be expressed in the following recapitulatory statements:

(I) The amount of tannin present in cloves ranges from 10 to 13 per cent. of the weight of the spice as found in the market.

(II) The tannin of cloves has the same percentage composition as gallotannic acid, and yields the same decomposition products as does that compound; hence, they are identical.

ANATOLIAN LICORICE ROOT.

By James W. Nickum, Ph.G.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. No. 141.

That a knowledge of the constituents of this variety of licorice root might be attained, 50 grammes of the air-dry drug in No. 40 powder were submitted to Dragendorff's scheme for proximate analysis. Consequently, the solvents were applied in the order in which their respective extracts are hereafter treated of.

The application of each solvent was repeated until no further action was exercised. The several portions so applied were filtered off and mixed. In the cases of the petroleum ether, ether and absolute alcohol extracts, the bulk of the solvent was recovered by dis-

tillation, after which operation, to estimate their amounts, the entire extracts were transferred to tared beakers and evaporated to constant weights on a water-bath.

The total solids of the water, alkaline water and acidulated water extracts were determined by evaporating an aliquot part of the solution to a constant weight by the means already described. The residue was ignited and the resulting ash deducted from the weight of total solids. The difference was taken as organic solids.

Both in the absolute alcohol and water extracts, glucose was tested for and estimated by making the liquid alkaline with sodium hydrate and then heating with Fehling's solution for twenty minutes on a water-bath. The cuprous oxide was then collected, washed, dried and converted by ignition into cupric oxide. Forty-five per cent. of the weight of the latter was considered to equal the amount of glucose present in the fractional part of the extract under examination. To estimate the sucrose an equal volume of the glucose containing liquid was boiled for one-half hour with a small quantity of hydrochloric acid to convert the former into the latter sugar. After this treatment, the liquid was allowed to cool, and, after having been made alkaline, was treated with Fehling's solution, as in the case of glucose alone. The increase in the amount of cupric oxide obtained upon the ignition of the cuprous oxide, that resulted from this treatment, was attributed to sucrose, the amount of which was calculated as 95 per cent. of the amount of glucose represented by the additional cupric oxide.

To obviate any discrepancy that might arise from the presence of extractive or glycyrrhizin, the water solution, previous to the application of the process for the determination of glucose and sucrose, was completely precipitated with neutral lead acetate. After filtering the mixture, the excess of lead was thrown out with hydrogen sulphide. The resulting lead sulphide was separated by filtration. The filtrate was warmed to expel hydrogen sulphide, then allowed to cool, and afterwards made up to a definite volume. Portions of this were then used for the determinations of the sugars.

The percentages of constituents stated in this paper are adjusted on the air-dry drug.

Petroleum Ether Extract.—Petroleum ether extracted ·54 per cent. of the weight of the root. Only a slight loss in weight occurred when this extract was heated to 120° C. Treatment with hot alco-

hol, sp. gr., ·820, left some caoutchouc undissolved. The clear, hot alcoholic solution, filtered from the above insoluble substance, became opalescent when allowed to cool, on account of the separation of wax. When it had become thoroughly cold, this opalescent mixture was filtered. The filtrate was evaporated on a water-bath, a residue of fat and wax being thereby obtained. In this residue there was noticed a crystalline principle which will be treated of more fully under a separate heading.

Ether Extract.—This represented 4·07 per cent. of the drug. About one-tenth of the extract was found to be soluble in cold water.

Absolute Alcohol Extract.—The amount of this extract equalled 6·64 per cent. of the drug. Cold water dissolved about one-half of it. The resulting solution had an acid reaction. It gave, with lead acetate, a considerable yellowish precipitate. Glucose was present to the extent of 1·04 per cent. The amount of sucrose found was 1·41 per cent.

A portion of the cold water solution of the alcoholic extract when treated with test solution of ferric chloride, yielded a dark, brownish-red precipitate; the liquid at the same time acquired a very dark red color. This treatment caused the development of a very strong, licorice-like odor. This odor was as decided as is that of the commercial extract of the drug. After obtaining this result other portions of the aqueous solution were tested with different oxidizing agents, that their effect might be observed. The same odor was produced by the addition of potassium permanganate. Mercuric chloride caused the same effect, but not to such a marked degree. As treatment with diluted hydrochloric acid did not develop the odor, it would seemingly not be due to the decomposition of a glucoside by the usual action of acids.

The results of these tests suggest the inquiry whether or not the odor and possibly the sweet taste of licorice, ensue from a process of oxidation that takes place in the plant during life, or upon drying. It is a well-known fact that these properties are restored in old licorice root by exposing it to an ammoniacal atmosphere; and, in the light of the above results, there arises a question as to a possible oxidation by the air in the favorable presence of the alkali.

That part of the absolute alcohol extract, which was insoluble in water, was almost entirely soluble in ammonium hydrate, only a very small quantity of resinous matter having failed to dissolve.

When this ammoniacal solution was acidified with dilute sulphuric acid, a precipitate was obtained, which was dried to a constant weight and thus estimated as glycyrrhizin. It amounted to ·48 per cent. of the entire drug.

Water Extract.—Water dissolved 10·34 per cent. of organic solids. A small quantity of albuminous matter was precipitated when some of the unevaporated solution was mixed with four volumes of absolute alcohol, and allowed to stand over night. The extract included 5·2 per cent. of glucose and 2·21 per cent. of sucrose.

Alkaline Water Extract.—This was obtained by treating the residue from the application of water to the drug with a ·2 per cent. solution of sodium hydrate in water. This solvent removed 1·14 per cent. of organic solids. A small quantity of albuminous or mucilaginous matter was detected by acidifying a portion of the liquid extract with acetic acid and then adding four volumes of absolute alcohol.

Acidulated Water Extract.—Water containing ·1 per cent. of hydrochloric acid extracted ·52 per cent. of organic solids, including pararabin. Phosphates and oxalates were also dissolved by the acidulated water.

The Crystalline Principle of the Petroleum Ether Extract.—This principle was first noticed when the residue left upon evaporating the alcoholic solution of the petroleum ether extract, and from which most of the wax had been separated by cooling, was viewed with a lens of low magnifying power. It formed numerous minute crystals of peculiar shapes, and was embedded in the fatty and waxy matters of the extract. Some of the crystals were fern-like in shape, some had the outline of the Maltese cross, while others were long, acicular and interlaced.

The residue containing the crystals was treated with distilled water. The water solution was evaporated to dryness on a water-bath. A very small quantity of distinctly crystalline residue was thereby obtained. This residue was again dissolved in water, and the resulting solution shaken with ether. When separated and allowed to evaporate spontaneously this solvent left a small amount of the crystalline substance. To obtain more of the principle a larger quantity of the same variety of licorice root was subjected to the process by which the crystals were at first isolated. A small

amount was again obtained. The crystalline residue obtained upon the evaporation of the water solution had a distinctly acid reaction, and a peculiarly sour or acid-like taste. The residue was treated with absolute alcohol, in which it was soluble. A few drops of the alcoholic solution were placed on a clean watch crystal, and allowed to evaporate spontaneously.

The watch crystal was examined with the compound microscope, by the aid of which the fern-shaped crystals already described were rendered very distinct. Another portion of the crystalline residue was treated with a small amount of distilled water. A few drops of this solution were transferred to a clean watch crystal, and there allowed to evaporate. Upon examining the residue left in this case with the compound microscope, long, acicular crystals, which interlaced, were observed. The yield from a kilo of the Anatolian licorice root was not sufficient for further investigation.

Three kilos of the Persian variety were manipulated in the same manner, in order to detect the principle and isolate it in larger quantity. Crystals of the same character were obtained from this variety also, and at the same stage of the process, but the small amount so obtainable, as also the limited time at the author's disposal, precluded their further investigation.

Moisture and Ash.—To determine the comparative amounts of moisture and ash contained, estimations were made on four varieties of licorice root.

A weighed quantity of each variety was dried to a constant weight in an air-bath at a temperature of 110° C. The loss in weight was taken as moisture.

To ascertain the amount of ash, the dried residue from the moisture determination was incinerated until the organic matter was consumed and no further loss in weight was experienced. The results were as follows:

	Moisture.	Ash.
Anatolian	7·58	8·84
Persian	7·49	5·43
Turkish (Russian)	6·31	5·04
Spanish	6·81	4·65

The figures given in the foregoing table for Anatolian licorice represent the moisture and ash of the root that was submitted to the proximate analysis described in this paper.

Action of Acetone.—Acetone was applied to each of the varieties of licorice previously mentioned. The treatment was continued until exhaustion was complete. After recovering the greater quantity of the solvent by distillation, the extracts were evaporated to constant weights on a water-bath.

The extract from the Persian variety equalled 5·07 per cent. It was transparent and of a bright, ruby red color. The Anatolian root yielded 23·84 per cent. of an extract that was much darker than the extract of the Persian variety. 7·02 per cent. of extract was obtained from the Spanish licorice root. This extract was lighter in color than any of the others obtained from the four varieties of root.

The Turkish root furnished an extract that was darkest in color. It amounted to 14·06 per cent.

A quantity of the Anatolian root was treated with alcohol, sp. gr. ·820, until exhausted. The amount of extract removed by this solvent was 13·74 per cent., as against 23·84 per cent. extracted by acetone.

Tannin.—The statement in Hanbury and Flückiger's Pharmacographia, that "a trace of tannin is found in the outer bark of licorice," led to some experiments by which the validity of that assertion might be tested.

A quantity of the outer bark of each of the four previously named varieties of the root was carefully scraped off. From these scrapings infusions were made by the use of cold water. The filtered liquids reacted as follows: Ferric chloride, no precipitates; ammonio-ferric sulphate, slightly dark precipitates; gelatin and alum afforded slight precipitates with the infusions, but others of the same character were obtained upon the addition of alum alone; dilute sulphuric or hydrochloric acid produced precipitates resembling very closely those caused by alum.

When these several reagents were applied to decoctions prepared from the outer bark by the use of hot water, the same reactions were shown.

To further investigate the possible presence of tannin, a decoction was made from a lot of ground drug that represented the entire root; the reagents, even when applied to this, failed to detect tannin. It may, therefore, be concluded that there is no tannin in licorice root.

STRUCTURE OF SASSAFRAS.

By Edson S. Bastin.

This American tree is the only living species of its genus, though the fossil remains from the cretaceous rocks of our Northwest prove that there were once several at least, and probably the genus was once as abundant in species as are now the oaks. This species has probably persisted beyond its congeners by reason of its ability to endure a wide range of conditions. This is evidenced by the fact that it thrives almost equally in the austere climate of Canada and in sub-tropical Florida, and that it endures almost every condition found in the forest regions between these Northern and Southern limits, and between the great plains on the West and the Atlantic coast on the East.

In the North it is a shrub, in middle and southern latitudes it is a tree, often with a trunk that attains a diameter of a foot or more, and a height of fifty or sixty feet. Its top, when growing in open ground, is also dense and shapely, so that the tree is not without value as an ornament to our parks and roadsides. The trunk is covered with a grayish, strongly-fissured bark, but the twigs remain green for several years, the corky layer being slow to form beneath the epidermis.

The alternate exstipulate, petiolate, deciduous leaves are remarkable for the variety of their forms on the same tree. Some are entire, oval and acute or obtuse, while others are more or less deeply separated into two or three unequal lobes, the lateral lobes being the shorter. This variability in the foliage of the tree has given origin to one of its botanical names, that recognized in the last edition of our Pharmacopœia, namely, Sassafras variifolium. This tree, in fact, well illustrates the vicissitudes of our botanical nomenclature. In the earlier editions of Gray's Manual we find it named Laurus sassafras, following Linnaeus. In the later editions it is called Sassafras officinale, the name given it by Nees. Salisbury named it Laurus variifolius, and now in the recent "List of Pteridophyta and Spermaphyta, growing without cultivation in Northeastern North America," the name Sassafras Sassafras (Linné) Karsten, is adopted, a name doubtless applied in strict accordance with the new rules for botanical nomenclature, but whose unpleasant effect upon the ear could not well be endured except in the hope that sometime between now and the millennium our botanical nomenclature will acquire something like a stable equilibrium.

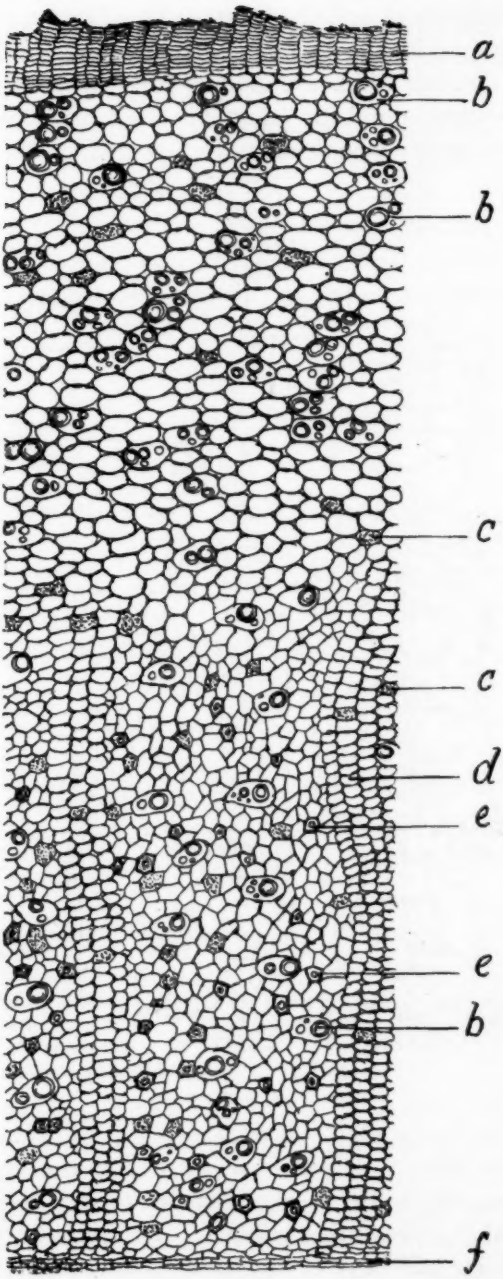

FIG. 1.

The tree is diœcious and the inconspicuous flowers appear in early spring, before or with the leaves. They are arranged in clustered corymb-like racemes which are involucrate with scaly bracts. The sepals, six in number and spreading, are yellowish-green, and in the staminate flowers the nine stamens are inserted in three whorls on

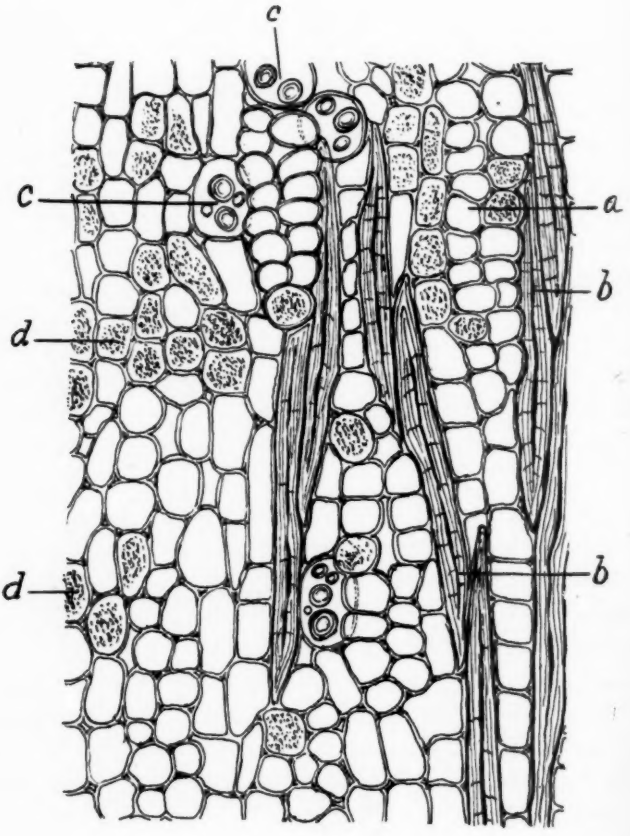

FIG. 2.

the base of the calyx. The stamens of the inner whorl differ from the rest in bearing at the base of each filament a pair of stalked glands, probably representing stipules. The anthers of all the stamens are introrse and have two pairs of loculi, one pair smaller and superposed over the other, and the loculi dehisce by valves.

The pistil in the staminate flower is wholly aborted. In the pistillate flower six stamens are present, but with wholly or partly aborted anthers and without pollen. The pistil is single, with an ovoid ovary and a single, rather short style terminated by a discoid stigma. The ovary contains usually a single ovule, which is anatropous and suspended from the top of the ovary.

The fruit is a bluish-black, ovoid drupe of the size of a pea, supported on a fleshy, club-shaped, reddish pedicel, crowned by the persistent reddish calyx teeth, which clasp the fruit at its base. The seed is exalbuminous.

All parts of the plant contain more or less of volatile oil, but this

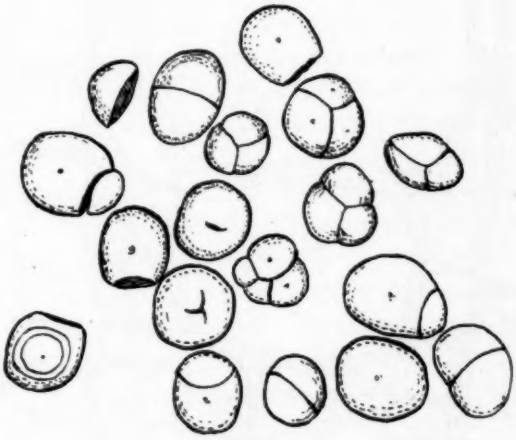

FIG. 3.

is much more abundant in the bark of the root, which, therefore, constitutes the most important medicinal portion.

The leaves and young twigs, particularly the pith of the latter, are rich in mucilage, which causes them to be employed, to some extent, for demulcent purposes.

A cross-section of the bark of a root which has attained a diameter of two inches or more shows a structure which is represented in the illustration, *Fig. 1*.

The friable exterior corky layer shows the usual microscopic appearance of corky tissue. The thickish middle bark beneath it is rich in oil cells, which average larger in size than the parenchyma cells among which they are scattered.

Oil cells are not confined to this layer, but occur, though somewhat less abundantly, among the sieve and companion cells of the inner layer of the bark. Parenchyma cells, rich in tannic matters, are also freely scattered through the middle and inner layers.

The medullary rays, whose course in the bark is usually some-

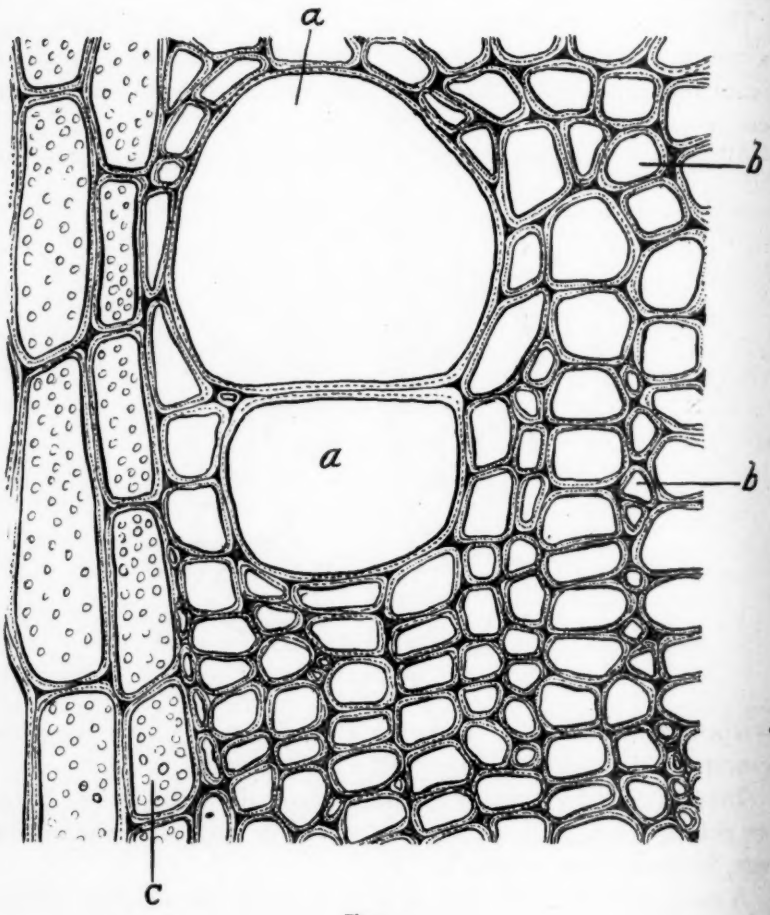

FIG. 4.

what wavy, are composed sometimes of one, sometimes of two, and more rarely of three rows of cells.

No primary bast fibres are formed in the root bark, and the bark of roots not more than two or three years old is usually destitute of bast fibres of any kind.

Later on, however, secondary bast fibres are formed, but these are never so abundant as to give an evident fibrous fracture to the inner layer of the bark. They are scattered without apparent order through the bast wedges, and are not usually clustered, though occasionally two or three may be seen in juxtaposition.

They are excessively thick-walled, and, for bast fibres, short, their length being not more than from ten to fifteen times their thickness. They are also hard and brittle.

If the bark be gathered in late autumn or in very early spring, the parenchyma cells of the bark, and even the thinnish-walled wood cells and medullary ray cells of the meditullium, are found to be heavily charged with starch grains. These are of rather small size, and, when single, are spherical or spheroidal in shape, with a central hilum, which sometimes shows a few stratification circles about it. The circles, however, are usually indistinct or wanting. The hilum is usually entire, and appears, even under a very high power, as a mere point, but it is sometimes angularly fissured. Compound grains, however, are more common than simple ones, the commonest being double and triple ones, though more complex forms are not uncommon.

In most structural characters the wood of the root and that of the stem resemble each other closely. The ducts, which are mostly of the pitted variety, with the pits closely arranged, are, in both, of large diameter, and usually grouped in twos or threes, but sometimes single. They agree also in the fact that the walls of the wood cells do not become so strongly thickened as they do in many other woody plants, and in the fact that the medullary ray cells are of rather large diameter as compared with the wood cells, are usually elongated in a radial direction, and are finely pitted. They differ chiefly in the conspicuous large-celled pith of the stem, which, of course, does not occur in the root at all, and in the fact that in the stem the medullary rays are rather more numerous and inclined to become fewer-rowed, three-rowed rays being seldom found.

The differences between the bark of the stem and that of the root are more conspicuous. Besides the inevitable difference due to the presence of chlorophyll in the middle bark of the former and its absence in the latter, and the difference in cork formation already alluded to, namely, the fact of its much more tardy formation in

the bark of the stem, the stem-bark contains clusters of numerous primary bast fibres associated with stone cells, which form an interrupted zone at the junction of the middle with the inner bark. Both primary bast fibres and stone cells are wholly wanting in the root-bark. The secondary bast fibres of the stem are similar in structure and arrangement to those of the root.

The volatile oil cells of the stem-bark, while they have a distribution quite similar to that in the root-bark, are very much less abundant.

DESCRIPTION OF FIGURES.

Fig. 1.—Transverse section of the root-bark of sassafras taken from a root about 2 inches in diameter. Magnification about 50 diameters. *a*, cork; *b*, *b*, *b*, volatile oil cells; *c*, *c*, cells containing tannic matters; *d*, medullary ray; *e*, *e*, bast fibres; *f*, cambium.

Fig. 2.—Small portion of longitudinal-tangential section of inner bark. *a*, medullary ray cell; *b*, *b*, bast fibres; *c*, *c*, volatile oil cells; *d*, *d*, cells containing tannic matters. Magnification about 110 diameters.

Fig. 3.—Starch of sassafras bark. Magnified 750 diameters.

Fig. 4.—Small portion of meditullium of root. Magnified 370 diameters. *a*, *a*, pitted ducts; *b*, *b*, wood cells; *c*, medullary ray cell.

SOME COMMERCIAL COCOAS.

By Florence Yaple, Ph.G.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. No. 142.

The history of cocoa, as an exhilarating and agreeable beverage, dates back to the time of the discovery of America by Columbus, it having been largely used by the natives of tropical America at that time. Introduced into Europe by the above discoverer, the drink became fashionable among the wealthy classes, and it was so highly esteemed by Linnaeus that he gave to the plants producing this fruit the name Theobroma, which means food of the gods.

The commercial activities of our time have increased the production and thereby cheapened the price of the commodity, so that now the cocoa preparations are largely consumed by all classes of people. The most popular of these are the so-called chocolates and cocoas, the latter probably superseding the former for table use, or, more particularly, in the preparation of the beverage.

Chocolate is made by grinding the roasted beans deprived of the husks, in heated rollers, which soften the fat, and while in this pasty condition the mass is mixed with sugar and afterward pressed in moulds. In the preparation of cocoa, the roasted beans, also deprived of the husks, are reduced by grinding to a fine, smooth paste and placed in bags and subjected to powerful pressure in heated presses. The fat exudes slowly and the residue, which is a solid, compact cake, is broken in pieces and finely powdered for use.

In practice, there are many modifications of these processes, such as the addition of flavoring and coloring substances and materials to give consistency, and sometimes even to give weight to the finished preparations.

The cocoas prepared as outlined above are considered more palatable and digestible than the chocolates, and hence are deemed worthy of a distinct classification.

It was with the view of making a comparative chemical examination of a few of the more popular brands of this class that the present work was undertaken.

The following is a list of the names of the preparations examined:

(1) Rowntree's Elect Extract of Cocoa; (2) Huyler's Caracas Cocoa; (3) Breakfast Cocoa (Croft & Allen); (4) Miller's Breakfast Cocoa; (5) Fry's Cocoa Extract; (6) Walter Baker & Co.'s Breakfast Cocoa; (7) Van Houten's Pure Soluble Cocoa; (8) Bensdorp's Pure Royal Dutch Soluble Cocoa; (9) J. & C. Blooker's Dutch Cocoa; (10) Wilbur's Breakfast Cocoa; (11) Cadbury's Cocoa Essence, and (12) Whitman's Pure Cocoa.

A moisture determination was first made by subjecting two grammes of the powder contained in a crucible to a temperature of 100° C. until a constant weight was obtained.

The dry residue from the preceding operation was then ignited at a low, red heat until the weight remained constant. The ashes were all light gray in color, some of them being nearly white or having a pinkish tinge. These were examined qualitatively, and were found to be composed almost entirely of the phosphates and carbonates of potassium, magnesium and calcium, with a small per cent. of iron in No. 1, and a trace of sodium in No. 7. The high percentages of ash in Nos. 8 and 9, and the still higher per cent. in

Nos 1 and 7, led to a further examination as to their solubilities in water and acid.

The water-soluble portion was obtained by treating the ash with water, filtering, evaporating filtrate and then carefully heating the residue. The portion insoluble in water was then treated with dilute hydrochloric acid and the insoluble residue carefully washed, dried and heated to redness.

It was found that in those samples having a high per cent. of ash, the proportion soluble in water was two or three times larger than in those brands having a lower per cent. of inorganic constituents.

The fat was determined in the following manner: 5 grammes of the powder were placed in a test tube and agitated with a convenient quantity of petroleum ether and allowed to settle, when the clear liquid was separated; this was repeated four or five times, or until all of the fat was removed. The petroleum ether was allowed to evaporate spontaneously, and the fat so obtained placed in a desiccator to deprive it of moisture. The melting point was then ascertained by simply exposing this residue contained in a beaker to the temperature of a water-bath. The melting points, so ascertained of the several samples, were found not to vary much, the range being from 37° C. to 40° C. This, together with the general appearance, was thought to indicate the genuine character of the fat contained in these brands.

The residue left after the extraction of the fat was exhausted with hot alcohol, sp. gr. 0 850, and this extract, while still warm, treated with basic lead acetate, to precipitate tannates, tartrates, etc. The filtrate was then evaporated, the residue taken up with chloroform, the mixture filtered, and the residue obtained upon evaporation to dryness weighed as theobromine.

That part of the sample undissolved by the treatment with hot alcohol was treated with cold water until the filtrate was nearly free from color, and the aqueous solution so obtained was evaporated to dryness and weighed as extractive.

The portion undissolved by the foregoing solvent was dried at 100° C. and calculated as starch, fibre, etc.

For the determination of starch 100 mg. of this residue were gently boiled for two hours with 50 c.c. distilled water acidulated with 2 per cent. of dilute sulphuric acid in a 250 c.c. flask, the water lost by evaporation being replaced from time to time. After filter-

ing and bringing the measure up to 100 c.c., 50 c.c. were made alkaline with sodium hydrate solution, filtered, 50 c.c. of Fehling's solution added, and the liquid kept at a temperature of 90° C. for half an hour, then filtered and the precipitate well washed with hot water, dried, ignited and the percentage of starch calculated from the cupric oxide so obtained.

Another portion of the powder, after treatment with ether to remove fat, was examined microscopically for the detection of foreign starches. The results were mostly negative as only one, No. 11 contained more of a foreign starch than would be allowable by accident. In No. 4 the character of the starch was somewhat changed by fermentation, and in No 7 the granules were considerably disintegrated, due probably to excessive heating. No. 2 contained a rather large amount of starch, but it seemed to be that of genuine cocoa.

The nutritive value that the cocoas are supposed to possess suggested the importance of a nitrogen determination that an idea of the quantity of albumenoids present might be had. To accomplish this, Kjeldahl's process was essentially carried out as follows: About 1 gramme of the powder was placed in a 500 c.c. flask with approximately 700 mg. of freshly precipitated and thoroughly washed mercuric oxide, 50 c.c. of sulphuric acid were added, the flask containing the mixture placed on a sand-bath, the heat regulated until frothing ceased, and the mixture raised to the boiling point until the liquid was clear and of a light straw color. To this liquid, while warm, potassium permanganate was gradually added until a permanent purple color was imparted. The addition of the potassium permanganate required considerable care, and it was necessary to add small quantities of water from time to time to keep the contents of the flask in a liquid condition. 25 c.c. of a solution of potassium sulphide (40 grammes in 1,000 c.c. of distilled water) were then added, and to this 50 c.c. of a saturated solution of potassium hydrate, or enough to render the liquid alkaline, and lastly, a few pieces of granulated zinc. This mixture was then distilled by means of a Liebig condenser into 50 c.c. of decinormal volumetric solution of oxalic acid, and the excess of acid neutralized by decinormal volumetric potassium hydrate solution. The albumenoids were calculated from these figures after having deducted the percentage of nitrogen found to exist as theobromine.

The following summary will serve for a comparative consideration of the results obtained by analysis:

Nos.	Moisture.	Ash.	Fat.	Extractive.	Theobromine.	Starch.	Albumenoids.
1	4·05	7·70	30·82	7·48	1·08	—	15·22
2	4·27	5·54	34·04	7·44	1·02	11·26	17·29
3	3·98	4·24	32·48	6·52	0·56	17·65	17·27
4	3·99	4·05	38·76	7·52	1·06	20·71	6·77
5	4·33	4·28	31·16	5·26	1·36	16·07	12·78
6	4·44	5·23	27·52	6·62	1·28	23·34	15·74
7	4·53	8·19	29·78	9·88	0·69	21·26	17·03
8	4·59	6·69	33·06	8·52	0·88	11·33	11·41
9	4·64	6·70	31·78	7·70	1·22	15·90	16·87
10	3·84	4·69	33·32	5·84	0·82	16·94	16·74
11	4·00	4·70	27·58	6·48	0·70	21·05	13·58
12	2·70	4·15	37·68	4·10	0·66	16·26	14·13
Average . .	4·11	5·51	32·33	6·94	0·94	17·43	14·56

These results do not warrant the conclusion that any of the above samples were adulterated, but rather point to the fact that they were free from any appreciable amount of foreign admixture.

The percentage of fat, however, was found to be more than some of the manufacturers' claims would lead us to expect.

The high ash in Nos. 1, 7, 8 and 9, and the dark color produced when the samples were heated with water, naturally led to the conclusion that they had been treated with a small quantity of inorganic material, probably for the purpose of rendering them more soluble.

NOTES ON SOME SAPS AND SECRETIONS USED IN PHARMACY.

By P. L. Simmonds, F.L.S.

[*Continued from p. 256.*]

Narthex asafœtida, Falconer; *Ferula Narthex*, Boissier. The *Ferula asafœtida*, Linné, of Persia, Afghanistan and Turkestan yields the ordinary medicinal gum resinous exudation locally known as *Anguzi*, but in India the pure drug is called "Hing," and the coarser kind "Hingra." Asafœtida contains two essential oils; although the odors of oil of garlic, oil of onions and asafœtida are similar, asafœtida contains no trace of allyl. An exhaustive paper on this essential oil has been published by Dr. Semmler. Its density is about 0·984.

Asafœtida is commonly used by the Mahomedan population of

India and the vegetarian Hindoo classes, as a favorite ingredient in their curries, sauce for pillaus, and other dishes, especially mixed with rice and dal or pulse on account of its stimulant, stomachic properties. The Turkomans are very fond of the young shoots dipped in vinegar. But it is not an article of general consumption in Afghanistan itself. The fresh leaves of the plant, which have the same peculiar odor as its secretion, when cooked, are commonly used as a diet by those near whose abode the plant grows. The white inner part of the stem of the full-grown plant is considered a delicacy when roasted and flavored with salt and butter. India seems to be the principal consumer of this gum resin, as the imports there range from eight to nine thousand hundredweight annually. Its uses in Persia are very numerous, especially as a medicine. There are people there who are so accustomed to its use for nervous complaints that it is like opium to the opium eaters—one of the necessaries of life. Its excellent anti-spasmodic qualities are too little known and appreciated in Europe.

The liquid form of asafœtida has, from the remotest times, been held in great estimation by Eastern doctors, and was once regarded as worth its weight in silver. It is highly esteemed as a carminative and condiment. If taken daily it is said to prevent the attacks of malarious fever.

Among the ancients, condiments to stimulate the sluggish appetite seemed to be in chief demand. Amongst these asafœtida, which is to-day highly relished in Persia and the East, was an indispensable ingredient; and it is even now used moderately by cooks in Europe to give flavor to some dishes and meats.

Opopanax Chironium, Koch. This gum resinous exudation from the juice of the roots is met with in lumps and tears, is opaque, of a disagreeable balsamic odor, of a bitter acrid taste. It has a slight resemblance externally to myrrh. In most of its properties it closely resembles asafœtida, and is now scarcely used in medicine in Europe, although found in the bazars of India.

Papaver somniferum, Linné. The concrete, inspissated juice from the capsules of this poppy, known as opium, is a valuable narcotic and anodyne, obtained by scratching the capsules and collecting the juice. Great Britain imports from 400,000 to 500,000 pounds of opium annually for medicinal purposes, chiefly from Turkey and Persia. The imports into the United States since the duty has been

removed, on October 2, 1890, have increased. The imports, in 1890, were 473,095 pounds of crude or unmanufactured, valued at £1,183,712 and 34,465 pounds prepared for smoking, value £269,586.

In the financial year ending to 1893, the imports were, of crude, 615,957 pounds, value £1,186,824.

The chief seat for the production of opium is India, where the export trade to China used to average 126,000 cwts., valued at £10,000,000, but of late years has been falling off.

The exports were:

	Cwts.
1869	74,955
1879	125,765
1889	122,160

The exports from India in the recent financial years, ending in March, have been as follows:

	Quantity, Cwts.	Value.
1891–92	121,701	£9,562,260
1892–93	104,658	9,255,013
1893–94	97,910	8,019,428
1895 (11 months, to February 7th)	89,865	8,617,604

The poppy is largely grown for the opium it yields in many of the provinces of China, hence the Indian exports now go to many other countries, especially Cochin China and the Straits settlements. The export share of the two provinces has been as follows, in late years:

	Cwts. Bengal.	Cwts. Bombay.
1891–92	83,221	38,480
1892–93	70,615	34,043
1893–94	63,853	34,057

The imports of sorts of opium into China in each of the last two calendar years (January to December) have been as follows, in piculs, of 1⅓ cwt.:

	1892. Piculs.	1893. Piculs.
Malwa (Bombay)	27,782	28,694
Patna	18,877	20,295
Benares	15,353	12,121
Persian	7,770	6,998
	70,782	68,108

The returns for 1894 are not yet to hand, but the Statistical Secretary of the Customs at Shanghai, in his report for 1893, stated: "The protection of the rupee enhanced the price of opium so

greatly that it placed the Indian drug beyond the means of a vast number of consumers, and this rise taking place concurrently with adequate supplies of native opium—which has so improved in quality that, it is averred, smokers prefer it to Malwa—renders it almost hopeless for the imported drug to continue to compete successfully with the excellent and ever-improving home-grown product."

There are two kinds of opium made in India; that for export to China is called "provision opium;" that to be used locally is known as "excise opium," and is moulded into cakes, which are stamped with the device of an Imperial Crown, and the legend "Benares Abkari," from being made in that district.

Excise opium, for internal consumption, is retailed to the consumer as a decoction, or in the form of two smoking mixtures, known, respectively, as Chandu and Madat. The excise opium yields to the Indian Government a revenue of about 1,000,000 sterling.

The opium for export is made up into round cakes or balls, about the size of a 24-lb. spherical shot. These are packed for shipment in chests, in two layers of 20 each, and the chests weigh about 140 pounds.

The expediency of the Government production and supply of Indian opium to China has been much discussed and questioned, and a commission has been taking evidence and reported on it.

It is doubtful whether the moderate use of opium smoking is more injurious to the system than other narcotics and intoxicants, and especially when the habit has been confirmed and is almost general in China, and the culture of the poppy is allowed and fostered in many of the provinces of the Empire.

The stimulant effects of opium are most apparent from small doses, which increase the energy of the mind, the frequency of the pulse, etc. These effects are succeeded by languor and lassitude. In excessive doses it proves a violent and fatal poison.

In disease it is chiefly employed to mitigate pain, produce sleep, and to check diarrhœa and other excessive discharges. It is also used with good effect in intermittent and other fevers. Combined with calomel, it is employed in cases of inflammation from local causes, such as wounds, fractures, etc.; it is also employed in smallpox, dysentery, cholera, and many other complaints. It is taken in various forms in different countries.

The Chinese both smoke and swallow it. In Turkey it is chiefly taken in pills, being sometimes mixed with syrup to render it more palatable.

In England the drug is administered either in its solid state, made into pills, or as a tincture in the shape of laudanum. The natives of India take it in pills or dissolved in water. In upper India an intoxicating liquor is prepared by beating the capsules of the poppy with jaggery and water.

The native practitioners consider opium to be injurious in typhus fever, but they administer it in intermittents, lockjaw, and in certain stages of dysentery; externally, they recommend it in conjunction with arrach, aloes, benzoin and bdellium, in rheumatic affections. They consider, however, after all, that it is merely efficacious in giving temporary relief.

Persian opium is cultivated principally in Yezd and Ispahan, and partly in the districts of Khorassan, Kerman, Fars and Shushtes.

That grown in Yezd is considered to be better than that of Ispahan and elsewhere, owing to the climate and soil of the place being better adapted to the growth of the poppy. The crop comes to hand in May and June, and the greater part of the opium finds its way to the shipping ports between September and January. These ports are Bushire and Bunder Affas. The Persian opium was formerly not much liked in China, owing to its having a peculiar flavor, caused by the mixture of a large quantity of oil during the process of preparation, and owing, also, to its being sometimes found adulterated. It, however, finds a better market in London, inasmuch as it contains, on an average, a larger quantity of morphia. From Yezd a quantity of opium prepared in the shape of small sticks or cylinders, is sent to Herat, and a small quantity in this form is locally consumed for smoking and eating.

Opium smoking is very prevalent in Yezd, and it is said that more is used in this place in that way than in any other town in Persia, with the single exception of Kerman. The habit is gaining ground daily throughout the country.

In late years there has been a decided decrease in the crop of Persian opium. A few years ago an average crop would be reckoned at 4,000 boxes; in 1889, a fair year, it was about 3,000; in 1893 it was only about some 2,000, but for 1894 an area was planted which is calculated to give some 2,500 boxes. It was anticipated that in

1895 a very much larger quantity will be planted. The Persian merchants are looking with keen and anxious eyes to the report of the opium commission in India, and their future conduct will be greatly biased by it.

In Khorassan the cultivation of the poppy has increased ten-fold within the last fifteen years. That destined for China is mixed with linseed oil, in the proportion of 6 or 7 pounds to each chest. That sent to England is pure. Persian opium is fast overtaking Patna opium in Chinese estimation, according to the advancing prices. A very few years ago it was quoted at less than half the price of the Indian drug.

The poppy is now grown in many parts of Europe, France, Germany, etc., and is even extending to Australia and Africa. Opium raised in Europe is stated to yield from 8 to 13 per cent. of morphine. The main value of opium depends on its contents of morphia, for which the genus *Papaver* (as far as heretofore known) remains the sole source.

Not less than fourteen alkaloids have been detected in opium by the progressive strides of organic chemistry.

The Persian opium is packed in chests containing a little over 1 cwt. The price in 1894 was £71, 10*s.* to £72, 10*s.* per chest. It is nearly all prepared for the China market, and there are only one or two native merchants who have sufficient knowledge to prepare the high-class article required by the London market. The crop was smaller than in previous years.

The total quantity prepared in Shiraz was about 1,300 chests, of an approximate value of £93,500.

The partial destruction of the opium crops in 1893 was a heavy blow to Persian commerce. The yield for the year was very poor, and the value of the total export shows a decrease of £132,000 when compared with the export of 1892. The exports from the port of Bunder Affas in 1892 and 1893 were as follows:

	Chests.	Value.
1892	746	£37,300
1893	743	36,578

Peucedanum Galbaniferum and Polylophium Galbanum.—These two plants are said to furnish the medicinal gum resinous exudation known as galbanum. It used to be referred to *Ferula galbaniflua*, Boissier, a Persian species. Galbanum may be distinguished from

other gum resins by its somewhat musky odor, and by being easily indented by the finger nail, especially where the tears have a blueish tint. It is more or less brownish-yellow, at ordinary temperatures tough, brittle when cold, of disagreeable smell, and acrid, nauseous, bitter taste. It is indigenous to Africa and sent to Constantinople under the name of "Khasni." The root is of a roundish form and about the size and shape of a large black radish, with two spreading shoots. The British imports are merely nominal. Galbanum is frequently used for plasters, and inwardly for menstrual illnesses in the country of its growth.

(*To be continued.*)

NOTES ON THE EIGHTH EDITION OF MARTINDALE'S "EXTRA PHARMACOPŒIA."

By Joseph W. England.

The eighth edition of William Martindale's "Extra Pharmacopœia" has just been issued through publisher H. K. Lewis, of London, England; and while it is largely based on the British Pharmacopœia and procedures of British pharmaceutical practice, it refers as well to the products and preparations of the U. S. Pharmacopœia. The work has a national reputation in Great Britain, and presents many features of interest to all pharmacists. It is not the writer's intention to review the book in this paper, but simply to jot down a few cursory thoughts on subjects of general interest which have occurred in perusing it.

Oddly enough, on page 123 reference is made to the "A. C. E. Anæsthetic Mixture" of alcohol (S. G. 0·838) 1 volume, chloroform (S. G., 1·497) 2 volumes, and ether (S. G., 0·735) 3 volumes, that found favor in this country some years ago. This mixture has been condemned by American surgeons, on the ground that its rate of volatilization is unequal, so that the anæsthetized patient is subjected to varying vapors, and not to an anæsthetizing vapor of uniform composition. Mr. Martindale has recognized this fault, and claims to obviate it by using the following formula: Absolute alcohol (S. G, 0·795) 1 volume, chloroform (S. G., 1·497) 2 volumes, and ether (S. G., 0·720) 3 volumes. He presents the results of experiments in support of this claim, which show a practically uniform rate of evaporation. The mixture has a specific gravity of about 1·01.

Prepared with U. S. P., absolute alcohol, chloroform and ether, the mixture would have a slightly lower gravity.

It is singular to note the influence that water in ether has of retarding anæsthesia. The writer has frequently observed that the higher the specific gravity of an ether, the greater the amount of it that was required to produce anæsthesia. To a degree, the higher the gravity of an ether, the more water it contains, and it seems reasonable to believe that it is the presence of water in ether and not so much the alcohol that retards anæsthetization, or rather renders an increased amount of ether necessary to produce it. That this is Mr. Martindale's opinion also, is evident from his improved formula for the "A.C.E. Mixture," in which he seeks to minimize, as far as practicable, the percentage of water present, by using absolute alcohol, and an ether stronger than that contained in the original formula. This "A.C.E. Mixture" is alleged to be safer than chloroform, and quicker in action than ether, though not so quick as chloroform; and the improved formula certainly deserves a thorough trial.

If petrolatum possesses therapeutic virtues—which, apart from its being demulcent to the mucous membrane of the alimentary canal, is doubtful—a formula for an emulsion of it with hypophosphites is given on p. 331, as follows:

Soft petrolatum	5 ounces (av.)
Powdered acacia	2·5 ounces (av.)

Mix and add 4 fluid ounces of water. Dissolve 120 grains each of sodium hypophosphite and calcium hypophosphite in 6 fluid ounces of water. Add to the above with constant trituration, and then add a sufficient quantity of water to measure 15 fluid ounces. Dose: 1 to 4 teaspoonfuls.

In the making of tincture of strophanthus, Mr. Martindale gives preference to Fraser's process as improved upon by himself (*i. e.*, exhausting the ground and dried seeds with ether, drying and exhausting with alcohol), to the U.S.P. process of simply percolating with a diluted alcoholic menstrum (alcohol 650 c.c. to water 350 c c.) without prior exhaustion with ether. In the writer's experience, Mr. Martindale's process is decidedly the better of the two. It may require a longer time than the present U.S.P. process; but the final product is surer of representing all the therapeutically active principles of the drug.

The author refers interestingly to Terebene (p. 410). He claims that, chemically, it consists of camphene, cymene, borneol and terpilene, the last named of which is alleged to be the active or toxic constituent of terebene.

The U.S.P., '90, states that terebene consists chiefly of pinene, and contains not more than very small proportions of terpinene and dipentene. Sadtler and Trimble, in their new text-book on "Chemistry" (p. 781) quote Dr. F. B. Power as stating that it consists chiefly of the hydrocarbons dipentene and terpinene, with some cymene and camphene. For the internal administration of terebene, other than inhalations of vaporized terebene, Mr. Martindale recommends the conventional method of giving the terebene in sugar. A much better way, in the writer's opinion, is to admix the terebene with an equal volume of olive oil, and emulsify with powdered acacia, sugar and water, flavoring with oil of gaultheria; each teaspoonful to contain 5 minims of terebene.

The formula is given (p. 224) for the French product "Glycero-alcohol," as follows: Glycerin, 333, distilled water, 146, and alcohol, a sufficient quantity to measure 1000. It has a specific gravity of about 1. It is much used in Paris as a solvent of alkaloids and other proximate principles, keeps indefinitely, and does not readily evaporate. It could doubtless be often used with advantage by American pharmacists for the making of standard solutions of alkaloids, etc.

Paraldehyde (p. 55) is recommended to be given in diluted syrup or almond mixture. A better method is to mix it with an equal volume of olive oil, and emulsify with powdered acacia, sugar and water, flavoring with oil of gaultheria. The writer of this paper is disposed to question the statement made on p. 56 that paraldehyde is probably the *principal* therapeutic agent in *Spiritus Ætheris Nitrosi* B.P. It may be an important constituent, but surely the contained ethyl nitrite is of equal or greater importance. It is known that paraldehyde has absolutely no diaphoretic action on the human economy, and from this fact it is very evident that the diaphoretic action of spirits of nitrous ether must be due to some constituent other than paraldehyde, and this is most probably ethyl nitrite.

For the making of "Creosote Pills," Mr. Martindale recommends (p. 180) the following formula:

Creosote	2 flu'd drachms.
Powdered soap	120 grains.

Place the creosote in a one ounce wide-mouth, stoppered bottle, add the soap, and mix well. Then digest on a water bath until they combine. Each 2 grains of the mass will contain, practically, 1 minim of the creosote. This mass can be combined with other ingredients without decomposition, as occasion requires.

The writer of this paper has used the following formula:

Creosote	12 minims.
Powdered licorice root	18 grains.

Triturate well until the licorice root has absorbed the creosote, and then add:

Powdered soap	1 grain.
Powdered acacia	6 grains.

Make up into a mass with an excipient of glycerin and syrupy glucose (1 part by volume of the former to 4 parts by volume of the latter). Divide into 12 pills, and enclose in gelatin capsules.

The licorice root absorbs the creosote, the soap—small in quantity as it is—softens the fibrous mixture, the acacia gives adhesiveness, while the excipient helps to form a plastic, non-friable mass readily made into pills. Encapsulating in gelatin is essential to mask the creosote odor.

The objection is sometimes made to creosote pills that only small quantities of creosote can be given in this way. Where relatively large quantities of creosote are desired to be given an excellent method is to admix the creosote with twice its volume of olive oil, and enclose in gelatin capsules. The use of the fixed oil in this connection is not objectionable. In point of fact, there are reasons for believing that its presence is of value in diminishing the causticity of creosote upon the gastric mucous membrane and in promoting its absorption.

SAGO CULTIVATION IN NORTH BORNEO.[1]

(*Metroxylon Sagu*, Rottb. *Metroxylon Rumphii*, Mart.)

The sago of commerce is a kind of starch prepared from the soft internal stems of certain palms, natives of the Malay Archipelago, Borneo, New Guinea, and possibly of Fiji. The word sago or sagu is said to be Papuan for bread.

There are two well-recognized species of sago palms. The smooth or spineless sago palm (*Metroxylon Sagu*) is specially abundant in

[1] Kew Bulletin.

Sumatra and adjacent islands. It does not reach so far eastward as New Guinea. In North Borneo it is known as *rumbia benar*. Wet, rich soils, especially at the base of mountains, are its favorite localities. This species is regarded as the principal botanical source of the sago received in Europe.

The thorny sago palm (*Metroxylon Rumphii*) is found further east than the other species. It is plentiful in New Guinea, and in the Moluccas and Amboyna.

Both sago palms resemble each other in general appearance, but the latter is a smaller tree, and it has its leaf-stalk and the sheaths enveloping the lower part of the flower spikes armed with sharp spines from one-half an inch to about one inch long. It has, moreover, decided littoral tendencies, and is abundant along the shores of many small islands, forming a dense, impenetrable belt. In North Borneo the thorny sago palm is known as *rumbia berduri*, or *rumbia salak*.

Some sago is obtained from the sugar palm (*Arenga saccharifera*) after the plant is exhausted of its saccharine juice. The sago palm of India is *Caryota urens*. The farinaceous part of the trunk of old trees is said by Roxburgh to equal the best sago from the Malay islands. In China, Japan and Florida, sago, differing in character of the starch grains from palm sago, is obtained from species of *Cycas* such as *C. revoluta* and *C. circinalis*. The commercial importance of the latter is very slight.

The cultivation of the true sago palms is entirely confined to the Eastern Archipelagos. The plants are difficult to grow elsewhere, and it is improbable that the industry will extend beyond its present limits. Both species of *Metroxylon* are monocarpic, and die after the seeds are ripened. The life of the plant lasts for about fifteen to twenty years, at the end of which period the terminal inflorescence is formed. In spite of the abundance of flowers very few fruits are produced; these occupy two or three years in ripening. The propagation of these palms is usually effected by means of suckers or stolons formed around the base of old trees.

An interesting account of sago cultivation in Province Dent, in British North Borneo, is included by Governor Creagh in the report on the Blue Book of Labuan for 1893. (*Colonial Reports*, No. 122, Annual, 1894.) As the subject has not hitherto been dealt with in these pages, the report, which has evidently been carefully prepared

on the spot by Mr. J. G. G. Wheatley, is reproduced for general information.

A REPORT ON SAGO CULTIVATION IN PROVINCE DENT.

The sago palm, from which is manufactured the well-known sago flour of commerce, resembles in appearance the cocoanut tree. The former is valued for its trunk alone, the nuts are useless, and the tree dies if allowed to fruit.

VARIETIES OF SAGO PALM.

(1) There are only two kinds of sago palm which are cultivated, the "rumbia benar" (true sago), and the "rumbia berduri" (the thorny sago), also known as "rumbia salak." In appearance both are the same, but on close inspection the stems of the latter, to which the leaves are attached, known as "pallapa," will be found to be covered with bunches of thorns about 1½ to 3 inches long.

MODE OF PLANTING.

(2) Sago grows chiefly on damp ground, subject to floods at certain times of the year. If grown in swamps, less sago is produced, and the trunks do not attain as great a height as when planted on clayey damp soil subject to floods periodically. Once planted, the tree withstands floods and brackish water, but in the latter it does not grow as fast and the trunks are small. Sago is planted chiefly by suckers sent out by the parent tree, which are carefully cut off under ground. In swampy ground the shoots are planted out at once, but in other localities the shoots are tied together in bundles and placed in wet, muddy ground until they have begun to send out roots, when they are planted out in holes 12 inches deep, 1 foot in diameter, and 4 to 6 fathoms apart. No earth is placed about the roots, but the plants are supported in an upright position by two sticks fixed on either side. The earth gradually fills the holes during rains and floods. One man with an assistant can plant 300 plants a day. After this, further attention is generally unnecessary for a year, and in some cases two years, when the jungle growth is cleared around the growing tree. Some planters regularly clear around the roots and cut away suckers if they are too abundant. *Rumbia berduri* is preferred to the *rumbia benar*, chiefly because the wild pigs do not attempt to destroy young plants, on account of the thorns. In planting *rumbia benar*, fences have to be made to keep out the pigs, which are very destructive. *Rumbia berduri* is

also reported to produce more raw sago, but the quality of flour is the same in both species. Each tree produces from four to five pikuls of raw sago (133 lbs.=1 pikul), being at the rate of one pikul per fathom of trunk. Both trees grow to the same dimensions, 24 to 42 feet in height, and in 1½ to 3 feet in diameter at the base of trunk. The sago palm is not subject to any disease; but, if a deep cut is made at the base of the trunk close to the earth, the pith is attacked by large maggots, which gradually eat their way into the centre of the tree, and in three or four months destroy the whole trunk. This is a favorite way of paying off a grudge among the natives. The sago tree takes from five to seven years to mature, according to the nature of the soil. During the third year the plant begins to send out shoots. These grow up with the parent tree, and in time give out suckers. If these are allowed to grow too freely they form a dense thicket around the mature trunks and give a great deal of trouble to the workers. Every year each clump produces a large number of workable trunks. During the fifth year the parent tree is ready to be cut down. In the meantime, the young shoots are rapidly developing, and in the seventh year probably three or four trees are ready, and so on, so that the sago tree, once planted, continuously supplies the planter with logs without giving him any trouble as regards their cultivation. The natives compare their sago plantation to a herd of cattle, and it would be difficult to reckon the number of logs that each clump may have produced in the space of forty or fifty years. When the sago tree is allowed to flower, the pith begins to diminish, and, if the mature trunks are not cut down regularly, the whole clump gradually deteriorates and the trees become stunted bushes instead of growing to the usual height. Nothing of the sago tree is lost. The trunk supplies the sago, the leaves and stems are largely used by natives for building purposes, the former for roofs and the latter for partitions and walls of houses, which, when properly constructed, are very neat-looking and durable. The top shoot makes an excellent vegetable, while the trunk, when split in two longitudinally, and the pith scooped out, is used as a boat to transport the raw sago which has been extracted from it. The bark, when taken off, makes excellent fuel, and an enterprising Chinaman, who employs an engine for rasping sago logs, uses this as a substitute for firewood.

The sago trade between Mempakul and Labuan is carried on by

native schooners of about forty tons, which ply regularly, and in fair weather are able to make a trip every two days.

The following are the figures recorded in the returns at Mempakul of the sago shipped to Labuan since January, 1890:

	Sago Flour.	*Raw Sago.*
1890	$23,483.72	$10,350.32
1891	24,826.67	18,560.20
1892	101,327.06	25,304.59
1893	119,092.70	25,034.24

The latter portion of the year is generally the busiest, as the rains assist in the transport of the raw material from streams which may have become too shallow during the dry weather.

The present price of sago flour at Singapore is $2.55 per pikul. The Chinese traders buy the raw material at from $1 to $1.20 per pikul, according to the market price at Singapore, and, after allowing for the cleaning of the raw sago and washing it in the factories, there remains a profit of at least 50 cents per pikul to the Chinese manufacturers. The freight from Labuan to Singapore at present is 22 cents per bag of 115 catties = 150 lbs. A royalty of 6 cents per pikul is charged on sago flour exported from Province Dent to Labuan, when the Singapore price is below $2.50, and 8 cents when above that sum. On raw sago a royalty of 8 cents is charged to protect the sago factories. The sago trade is increasing rapidly on the Borneo Coast, and at the present time over three-fourths of the flour and raw sago exported from and imported into Labuan comes from British North Borneo ports.

(Signed), J. G. G. WHEATLEY,
Magistrate, Province Dent.

MEMPAKUL, September 15, 1894.

Seeds without Fertilization.—Some years ago, Mr. John Smith, the Curator of the Kew Gardens, had a plant of the Euphorbia family, which was wholly pistillate—not another plant was known in Europe—and yet it produced perfect seeds. On this account, the plant being of a new genus, he named it "*Cælebogyne*," a Greek term representing this curious behavior. Peculiarities of this kind seem incomprehensible, and yet they are generally believed in by scientific men. Mr. David H. Day, of Buffalo, writes that he is quite sure a pistillate plant he has of *Thalictrum Fendleri* produces seeds without being pollenized, and the writer of this paragraph, one year, cut off all the pollen-bearing flowers of the castor-oil plant, so that not a particle of pollen perfected, and yet the plant produced its complement of seeds. The whole experiment, however, can be so easily repeated, that it is much better to consider this result as only a possibility until further experiments have been made.—*Meehan's Monthly for April, 1895.*

EDITORIAL.

PHARMACEUTICAL DEGREES.

It was announced in the April number of this JOURNAL that the Philadelphia College of Pharmacy had decided to establish a three years' course of study, instead of the present one of two years; and, in order to compensate for this additional study, it had been decided to confer on graduates, who have had four years' practical experience in the drug business, the degree of Doctor of Pharmacy.

There have always been in attendance at the College a number of students, who, for various reasons, have not taken store experience because of their intention to study medicine, or to take positions in manufacturing laboratories. It has also been decided to grant a degree to the individuals of this class. The title conferred on them for three years' attendance at the College, and the passing of satisfactory examinations, will be that of Pharmaceutical Chemist.

The degree of Graduate in Pharmacy will not be awarded after the graduation of the class now in course.

The reasons for conferring the degree of Doctor of Pharmacy have already been clearly set forth by Professor Remington in the paper referred to, and further argument seems unnecessary at the present time.

As was anticipated, some opposing criticism has already appeared in the medical press. It is natural that certain elements in the medical profession should be jealous of encroachment by the pharmacist, even if it is only in the field of titles. They may be reminded, however, that the candidate for the degree of Doctor of Pharmacy will have given one year more to the study of his profession than was until a comparatively recent period required of the candidate for the degree of Doctor of Medicine.

It has not been so long since two years of study in our leading medical schools sufficed to procure the medical degree. Is it reasonable to expect the pharmaceutical student to be content with simply the statement that he is a graduate in pharmacy after he has devoted three years to the study of his profession?

The Philadelphia College of Pharmacy has not taken this step to gain an advantage over other colleges of pharmacy, for they can, and probably will, be conferring the same degree within two years, but because it has been evident for some time that the pharmaceutical profession of the United States demands something more than the title of Graduate in Pharmacy.

The editor of the *Pharmaceutische Rundschau*, of New York, has ventured to assume the rôle of a prophet, and to predict the calamities which will befall the two professions of pharmacy and medicine if the degree of Doctor of Pharmacy shall be conferred.

The editor of the *Medical News*, of Philadelphia, echoes these prophetic arguments, and supplements them with the following wail: "The Doctors of Divinity have largely gone into the patent-medicine business in opposition to physicians; and now if every druggist also turns doctor, what in the world may the medical men do, and what may they be called?" So far as his deploring the opposition of the D.D. is concerned, we can only say that, in his sweeping arraignment of the clergyman, the editor probably did not intend to make it appear that the physician is in the patent-medicine business, too, but it

is unfortunate that the latter often, though unwittingly serves as a cat's paw for the patent-medicine manufacturer by prescribing his remedies. What he will do when every druggist turns doctor is too hard a question for us to answer, as we do not possess the necessary faculty of seeing into the future, but we suggest that he keep out of the clutches of the patent-medicine manufacturer and that he confine himself to the legitimate practice of medicine.

THE AMERICAN PHARMACY FAIR.

The American Pharmacy Fair was held at Boston, from the 1st to the 25th of May. It has been announced as the first of the kind in America. While it was not the first pharmaceutical exhibition held in this country, we agree that it was the first of its kind.

It failed in a few important particulars to represent American pharmacy. In the first place there was but one retail drug store exhibited, and that was by a "store-fixture" firm in the interest of the fixtures, so that real pharmacy may be said to have been conspicuous by its absence.

There were very few exhibits of crude drugs or chemicals.

A few firms exhibited manufactured pharmaceutical products, and these products were not of the kind to be of educational value, many of them being simply for this or that disease.

The most creditable exhibit was that of the Massachusetts College of Pharmacy, which displayed a sample of every preparation in the U. S. Pharmacopœia and the National Formulary—over 1,600 in all; these were made by students of the Institution.

Had the fakir and the nostrum-manufacturer been excluded, the omissions and shortcomings might have been overlooked, but with some one offering you a cure at every turn for every disease, from dyspepsia to delirium, it became unbearable. We regret that the words "American Pharmacy" were associated with the undertaking, and we are not surprised to learn that its doors were closed ten days before the time advertised for this to take place. Lack of funds was given as the immediate cause of the disaster.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

MISSOURI BOTANICAL GARDEN. Sixth Annual Report. St. Louis, Mo. 1895.

Much valuable space is gained for more scientific matters in the Sixth Annual Report by the omission of the section consisting of "Anniversary Publications," comprising the annual flower sermon and the proceedings at the two annual banquets; the report of the Director, Dr. William Trelease, containing all that it is considered necessary to state concerning these matters which are of local or temporary interest.

In addition to the reports of the officers of the Board and the Director, the volume contains 100 pages devoted to the following scientific papers:

Revision of the North American Species of Sagittaria and Lophotocarpus, by Jared G. Smith.

Leitneria Floridana, by William Trelease.

Studies on the Dissemination and Leaf Reflexion of Yucca aloifolia and other species, by Herbert J. Webber.

Notes and Observations on New or Little Known Species, by Jared G. Smith.

Notes on the Mound Flora of Atchison County, Missouri, by B. F. Bush.

Eighteen full-page illustrations adorn the work and add to its interest and value. The whole book is especially valuable to botanists and horticulturists, although any intelligent person can read it with profit.

BIOGRAPHICAL SKETCH OF DR. J. BERNARD BRINTON (with Portrait). Reprinted from the *Bulletin of the Torrey Botanical Club*, Vol. 22, No. 3, March, 1895.

The subject of this sketch excelled in several departments of science, but his greatest success was attained in the field of botany. He was a member of the Academy of Natural Sciences, of the Torrey Botanical Club and of the Philadelphia Botanical Club, which he founded in 1892. He was an extensive collector, and possessed an herbarium of large proportions, which he had labeled and preserved with the most scrupulous care.

Dr. Brinton was born near Waynesburg, Chester County, Pa., August 16, 1835, and died in Philadelphia, December 6, 1894.

THE EXTRA PHARMACOPŒIA. By William Martindale, F.C.S. Eighth Edition. Pp. 584. London. H. K. Lewis. 1895.

In the anticipation of the production of a new British Pharmacopœia, Mr. Martindale has for some time been engaged in investigating the claims of many new drugs and preparations for official recognition. The work, therefore, includes notes on the proposed revision, and through the analysis of 25,500 prescriptions by the author, lists have been compiled of unofficial preparations which, seem to require admission, and of official preparations which, not being in demand, might be deleted.

The Extra Pharmacopœia, in the eight editions it has now passed through, has attained a well-deserved reputation for a concise treatment of most unofficial drugs and preparations; at the same time it includes some official substances. The author very appropriately remarks in the preface: "A tangent of an important character has been projected in the direction of preparations from the animal kingdom, which till recently had been almost entirely neglected as curative agents. We have, therefore, inserted a special chapter on Antitoxins, Serums and Lymphs, and on Animal Glands and Tissues and their preparations."

Some further investigations have been included, notably the observations on "A. C. E." (Alcohol, Chloroform, Ether) mixture (see paper by Mr. Joseph W. England on page 328 of this issue). The latest researches on the alkaloids of Aconite and Ipecacuanha, including Aconitine, Emetine and Cephaëline, which will have an important bearing on therapeutics, have been added.

As attested by its eight editions, the book is a valuable one for reference, not only by those using the British Pharmacopœia, but by every one who prescribes or dispenses medicines.

The medical references and therapeutic index of diseases and symptoms have, as usual, been contributed by W. Wynn Westcott.

PENNSYLVANIA PHARMACEUTICAL ASSOCIATION

The next meeting of this Association will be held at Eagles Mere, Pa., on Tuesday, June 18, 1895. Detailed information can be obtained by addressing J. A. Miller, Harrisburg, Pa.

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